

## CLAIMS

What Is Claimed Is

1. A musical wind instrument comprising,

a tubular main air path,

at least three tubular length extension detour air paths, and

at least three air valves,

in which the at least three air valves are connected in series with one another and in series within the tubular main air path, a first entry port of each of the at least three air valves sequentially receiving air from a segment of the tubular main air path, and a first exit port of each of the at least three air valves returning air to a continuation of the tubular main air path,

each of the at least three air valves containing at least two internal air passages and having an associated external valve actuator, and each of the at least three air valves having two valve operating positions for selecting between immediate continuation of an air flow in the tubular main air path and diversion of the air flow into one of the at least three tubular length extension detour air paths prior to continuation in the tubular main air path,

in which a disengaged first of the two valve operating positions occurs with a specified valve selected from among the at least three air valves whenever an associated actuator of the specified valve remains inactive, and in which the

disengaged first of the two valve operating positions causes the specified valve to select immediate continuation of the air flow in the tubular main air path via a primary internal air passage selected from among the at least two internal air passages within the specified valve, the primary internal air passage leading directly from the first entry port of the specified valve to the first exit port of the specified valve whenever the specified valve is in the disengaged first of the two valve operating positions, the first exit port exiting to the continuation of the tubular main air path,

and in which an engaged second of the two valve operating positions occurs with the associated actuator of the specified valve being activated, and in which the engaged second of the two valve operating positions causes the specified valve to select diversion of the air flow to a second exit port on the specified valve, the second exit port exiting to an entry end of a specified valve associated one of the at least three tubular length extension detour air paths external to the specified valve, and an exit end of the specified valve associated one of the at least three tubular length extension detour air paths being connected to a second entry port on the specified valve causing the diverted detoured air to return to the specified valve via the second entry port and an aligned return internal air passage selected from among the at least two internal air passages within the specified valve, the return internal air passage being further aligned with the first exit port of the specified valve, causing the returned detoured air to exit the specified valve to a continuation of the tubular main air path whenever the specified valve is in the disengaged first of the two valve operating positions,

the tubular main air path further comprising

a mouthpiece receiver to receive air from an inserted cupped mouthpiece,  
and

a tubular entry air path with an entry end of the tubular entry air path  
connected to an exit end of the mouthpiece receiver and an exit end of the  
tubular entry air path being connected to the first entry port of a first  
encountered of the at least three air valves,

the tubular main air path further comprising at least two valve interconnect  
tubular passages with an entry end of a first of the at least two valve  
interconnect tubular passages being connected to the first exit port of the  
first encountered of the at least three air valves, and an exit end of the first  
of the at least two valve interconnect tubular passages being connected to  
the first entry port of a second encountered of the at least three air valves,  
and with an entry end of a second of the at least two valve interconnect  
tubular passages being connected to the first exit port of the second  
encountered of the at least three air valves, and an exit end of the second of  
the at least two valve interconnect tubular passages being connected to the  
first entry port of a third encountered of the at least three air valves,

the tubular main air path further comprising

the primary internal air passages of the at least three air valves,

a tubular exit air path,

a tubular bell throat of progressively expanding bore, and

a tubular bell flare,

in which an entry end of the tubular air exit path is connected to the first exit port of a last encountered of the at least three air valves and an exit end of the tubular air exit path is connected to an entry end of the tubular bell throat, and an exit end of the tubular bell throat is connected to the entry end of a tubular bell flare, and an exit end of the tubular bell flare projects musical sound waves to a surrounding external atmosphere,

and in which a total primary air path length approximately equals a summation of the length of the tubular main air path and the additional path length occurring within a portion of a cupped mouthpiece and between an entry end of the invention mouthpiece receiver and an exit aperture formed within a performing musician's vibrating lip embouchure, and the total primary air path length being selected from a group consisting of approximately 216 inches, approximately 192 inches, approximately 162 inches, approximately 144 inches, and approximately 108 inches, a total primary air path of approximately 216 inches corresponding to the musical key of BB-flat, a total primary air path of approximately 192 inches corresponding to the musical key of CC, a total primary air path of approximately 162 inches corresponding to the musical key of E-flat, a total primary air path of 144 inches corresponding to the musical key of F, and a total primary air path of 108 inches corresponding to the musical key of B-flat.

and in which a first encountered section of the tubular main air path exhibits a length of approximately 20 percent of the total primary air path length, and in which a second encountered section of the tubular main air path immediately follows the first encountered section, in which the second

encountered section exhibits a length of at least 10 percent of the total primary air path length, and in which the second encountered section has a bore of at least 0.495 inch and includes at least two sub-sections of air path in which a second encountered of the at least two sub-sections has a bore at least 0.007 inch larger than a first encountered of the at least two sub-sections of air path, and in which the bore of the tubular main air path does not exceed 0.850 inch within the first 65% of the total primary air path length, and preferably does not exceed 0.790 inch within the first 65% of the total primary air path length,

and in which the progressive bore of tubing within the second encountered section is a bore progression selected from among a group consisting of progressively increasing cylindrical bores, a gradually expanding conical bore, and a combination of cylindrical and conical bores,

and in which the interface between the at least two sub-sections of differing bore within the second encountered section may be an interface selected from among a group consisting of a sudden stepped increase in cylindrical bore, a brief rapid conically expanding increase in bore, a gradual conically expanding increase in bore, and a combination of stepped cylindrical and conical expansions in bore,

the invention progressive bore design of the second encountered section and the invention limited maximum bore size of 0.85 inch within the first approximately 65 percent of total primary air path being distinguished in that the progressive bore design imparts an amplifying musical effect which makes the invention easier to blow, easier to blow loudly when desired, and musically more responsive to play, while the limited maximum bore size within approximately the first 65 percent of total primary air path maintains

tone qualities characteristic of and desirable in a bass trombone, contrabass trombone, or cimbasso.

2. A musical wind instrument according to claim 1, in which the bell throat diameter measured 10 inches from the exit end of the bell flare is between 1.2 inches and 2.5 inches in diameter.
3. A musical wind instrument according to claim 1, in which the bore progression allows early placement of the at least three air valves within a section of reduced bore tubing selected from among a group consisting of the first encountered section of tubing and the first encountered subsection of the second encountered section of tubing, and in which the early placement of the at least three air valves allows use of smaller bores within the internal air passages of the at least three air valves without inducement of a mismatch in bore size between the bore of internal air passages of the at least three air valves and a proximal section of reduced bore tubing in which the at least three air valves are located, such that the at least three valves may be more compact, less massive, and exhibit lower friction, shorter throw, and lower spring tension valves in a nonlimiting example, providing for smoother operation and more nimble musical performance, and facilitating easier execution of technically difficult musical passages,
4. The musical wind instrument according to claim 1, in which a first combination path length is approximately the summation of a tubular path length of a second of the at least three tubular length extension detour air paths connected to a second encountered of the at least three air valves in series within the main tubular path and an air path length of the return internal air passage within the second encountered air valve, the first

combination path length being approximately 5.946 percent of a first total path length, in which the first total path length is a summation of the tubular main path length, the primary internal air passage length of each of the at least three air valves, the tubular bell throat air path length and the tubular bell flare air path length,

and in which a second combination path length is approximately the summation of a tubular path length of a first of the at least three tubular length extension detour air paths connected to a first encountered of the at least three air valves in series with the main tubular air path and an air path length of the return internal air passage within the first encountered air valve, the second combination path length being approximately 5.946 percent of a second total path length, in which the second total path length is a summation of the first total path length and the first combination path length,

and in which a third combination path length is approximately the summation of a tubular path length of a third of the at least three tubular length extension detour air paths connected to a third encountered of the at least three air valves in series with the main tubular air path and an air path length of the return internal air passage within the third encountered air valve, the third combination path length being approximately 5.946 percent of a third total path length, in which the third total path length is a summation of the first total path length and the second combination path length.

5. The musical wind instrument according to claim 1, in which the at least three air valves are selected from a group consisting of piston valves and rotary valves, in which the rotary valves are further selected from a group

comprising conventional rotary valves, S.E. Shires rotary valves, O.E. Thayer rotary valves, R. Hagmann rotary valves, Greenhoe rotary valves, Willson Rotax rotary valves, C. Lindbergh rotary valves, or any known rotary valve.

6. The musical wind instrument according to claim 1, in which the main air path length is approximately 108 inches, corresponding to the musical key of B-flat, and at least four valves and at least four tubular length extension detour air paths are employed, with one of the at least four tubular length extension detour air paths being associated with each of the at least four valves, and in which the second encountered section of air path commences after approximately the first ten percent of tubular main path length, the second encountered section comprising at least ten percent of the main air path, and in which the second encountered section exhibits a bore selected from a group consisting of an essentially single valued, essentially constant cylindrical bore and the progressive bore options described in claim 1.

7. A musical wind instrument according to claim 1, in which the approximately 216 inch tubular main air path BB-flat wind instrument and the approximately 192 inch tubular main air path CC wind instrument each have at least four air valves, and in which the approximately 162 inch tubular main air path E-flat wind instrument and the approximately 144 inch tubular main air path F wind instrument each have at least five air valves.

8. A B-flat "full double" musical wind instrument comprising,  
  
an introductory tubular air path,



a primary tubular B-flat main air path,

an alternate tubular F main air path,

at least six length extension tubular detour air paths ,

at least four rotary air valves,

an exit tubular air path,

a tubular bell throat of progressively expanding bore, and

a tubular bell flare,

in which each of the valves has two operating positions including a disengaged first operating position and an engaged second operating position,

and in which a total primary B-flat air path comprises in series and in connected sequence, a space within a cupped mouthpiece and situated between an exit aperture formed within a performer's lip embouchure and an entrance to the introductory tubular air path, the introductory tubular air path, a first internal air passage within a first encountered of the at least four air valves, the primary tubular B-flat main air path, a first internal air passage within each of three remaining air valves of the at least four air valves, the first internal air passages within each of the three remaining air valves being sequentially encountered in series with one another and contained in series within the primary tubular B-flat main air path, a second internal air passage within the first encountered air valve, the exit tubular

air path, the tubular bell throat, and the tubular bell flare, wherein the total primary B-flat air path is approximately 108 inches in total path length, corresponding to the musical key of B-flat, when each of the at least four valves is in the disengaged first of the two valve operating positions,

and in which a total alternate F air path comprises in series and in connected sequence, the space within the cupped mouthpiece and situated between the exit aperture formed within the performer's lip embouchure and the entrance to the introductory tubular air path, the introductory tubular air path, the first internal air passage within the first encountered of the at least four air valves, the alternate tubular F main air path, a second internal air passage within each of three remaining air valves of the at least four air valves, the second internal air passages within each of the three remaining air valves being sequentially encountered in series with one another and contained in series within the alternate tubular F main air path, the second internal air passage within the first encountered air valve, the exit tubular air path, the tubular bell throat, and the tubular bell flare, wherein the total alternate F air path is approximately 144 inches in total path length, corresponding to the musical key of F, when the first encountered of the at least four air valves is in the engaged second of the two valve operating positions, and when each of the remaining three air valves of the at least four air valves is also in the disengaged first of the two valve operating positions,

and in which the primary tubular B-flat main air path and the alternate tubular F main air path are separate, distinct, and mutually exclusive air paths which are selected by the operating position of the first encountered air valve,

in which the primary tubular B-flat main air path is selected whenever the first encountered air valve is in the disengaged first of the two valve operating positions, the alternate tubular main F air path being completely bypassed when the first encountered air valve is in the disengaged first of the two valve operating positions,

and in which the alternate tubular F main air path is selected whenever the first encountered air valve is in the engaged second of two valve operating positions, the primary tubular main B-flat air path being completely bypassed when the first encountered air valve is in the engaged second of the two valve operating positions,

and in which the first internal air passages of the remaining three of the at least four air valves are connected in series with one another and in series with the primary tubular B-flat main air path, a first entry port of each of the remaining three of the at least four air valves sequentially receiving air from a segment of the primary tubular B-flat main air path and a first exit port of each of the remaining three of the at least four air valves returning received air to a continuation of the primary tubular B-flat main air path whenever the first encountered air valve is in the disengaged first of the two valve operating positions,

each of the three remaining air valves of the at least four air valves containing at least four internal air passages and having an associated external valve actuator, and

the two valve operating positions of each of the three remaining air valves of the at least four air valves selecting between immediate continuation of an air flow in the primary tubular B-flat main air path and a diversion of the air

flow into a specified valve associated one of the first three of the at least six tubular length extension detour air paths whenever the first encountered air valve is in the disengaged first of the two valve operating positions, in which the immediate continuation of the air flow in the primary tubular B-flat main air path is selected whenever the associated valve actuator of the specified valve selected from among the three remaining valves remains inactive causing a disengaged first of the two specified valve operating positions to be selected and whenever the first encountered valve is also in the disengaged first of the two first encountered valve operating positions,

whereas the diversion of the air flow into the specified valve associated one of the first three of the at least six tubular length extension detour air paths is selected whenever the associated valve actuator of the specified valve selected from among the three remaining valves is activated causing the engaged second of the two specified valve operating positions to be selected with the first encountered valve being in the disengaged first of the two first encountered valve operating positions, the diversion of air flow received from the first entry port of the specified valve selected from among the three remaining valves proceeding via diversion to a second exit port on the specified valve, the second exit port exiting to an entry end of a specified valve associated one of the first three of the at least six tubular length extension detour air paths external to the specified valve, and an exit end of the specified valve associated one of the first three of the at least six tubular length extension detour air paths being connected to a second entry port on the specified valve, causing diverted air to return to the specified valve via the second entry port and an aligned third internal air passage selected from among the at least four internal air passages within the specified valve, the third internal air passage being further aligned with the first exit port of the specified valve, causing the returned detoured air to exit the specified valve

to a continuation of the primary tubular B-flat air path when the specified valve is in the engaged second of the two specified valve operating positions and the first encountered valve is also in the disengaged first of the two first encountered valve operating positions,

and in which the second internal air passages of each of the remaining three of the at least four air valves are connected in series with one another and in series with the alternate tubular F main air path, a third entry port of each of the remaining three of the at least four air valves sequentially receiving air from a segment of the alternate tubular F main air path and a third exit port of each of the remaining three of the at least four air valves returning air to a continuation of the alternate tubular F main air path whenever the first encountered air valve is in the engaged second of the two valve operating positions,

and the two valve operating positions of each of the three remaining air valves of the at least four air valves alternatively selecting between immediate continuation of an air flow in the alternate tubular F main air path and diversion of the air flow into a specified valve associated one of the remaining three of the at least six tubular length extension detour air paths whenever the first encountered air valve is in the engaged second of the two valve operating positions, in which the immediate continuation of the air flow in the alternate tubular F main air path is selected whenever the associated valve actuator of the specified valve selected from among the three remaining valves remains inactive causing a disengaged first of the two specified valve operating positions to be selected and whenever the first encountered valve is also in the engaged second of the two first encountered valve operating positions,

whereas the diversion of the air flow into the specified valve associated one of the remaining three of the at least six tubular length extension detour air paths is selected whenever the associated valve actuator of the specified valve selected from among the three remaining valves is activated causing the engaged second of the two specified valve operating positions to be selected with the first encountered valve being in the engaged second of the two first encountered valve operating positions, the diversion of the air flow received from the third entry port of the specified valve selected from among the three remaining valves proceeding via diversion to a fourth exit port on the specified valve, the fourth exit port exiting to an entry end of the specified valve associated one of the remaining three of the at least six tubular length extension detour air paths external to the specified valve, and an exit end of the specified valve associated one of the second three of the at least six tubular length extension detour air paths being connected to a fourth entry port on the specified valve, causing the diverted air to return to the specified valve via the fourth entry port and an aligned fourth internal air passage selected from among the at least four internal air passages within the specified valve, the fourth internal air passage being further aligned with the third exit port of the specified valve, causing the returned detoured air to exit the specified valve to a continuation of the alternate tubular F main air path when the specified valve is in the engaged second of the two specified valve operating conditions and the first encountered valve is also in the engaged second of the two first encountered valve operating positions,

and in which the internal air passages of the at least four valves exhibit bores of at least 0.490 inch, and in which bores of the first encountered approximately 65 percent of the total primary B-flat air path do not exceed 0.850 inch in diameter.

9. A B-flat full double musical wind instrument according to claim 8, in which the valve actuator of the first encountered of the four air valves is positioned in a location selected from among a group consisting of a location proximal to the little finger of a performer's hand at the same time the index finger of the performer's same hand is positioned on the actuator of the first encountered of the remaining three of the four air valves and a location proximal to the performer's opposite hand.
10. A B-flat full double musical wind instrument according to claim 8, in which the valve actuator of the first encountered of the four air valves is positioned in a location proximal to the little finger of a performer's hand at the same time the index finger of the performer's same hand is positioned on the actuator of the first encountered of the remaining three of the four air valves, and in which the actuator of the first encountered of the four air valves is a first of two actuators, the first of the two actuators being the actuator which directly actuates the valve, and the first of the two actuators being operable in a mode selected from a group of modes consisting of a completely independently operable mode in which the first of the two actuators is directly operated by the little finger of the performer's hand in which the index finger of the performer's same hand is positioned on the actuator of the first encountered of the remaining three of the four air valves and a dependently operable mode, in which the first of the two actuators is engaged by a second of the two actuators, the second of the two actuators being operated by the performer's opposite hand, wherein the first encountered of the four air valves may be conveniently actuated by either of the performer's two hands.
11. A B-flat full double musical wind instrument according to claim eight, in which a first encountered section total primary B-flat air path air path

exhibits a length approximately ten percent of the total primary B-flat air path length, and in which a second encountered section of the total primary B-flat air path immediately follows the first encountered section, and in which the second encountered section exhibits a length of at least 10 percent of the total primary B-flat air path length, and in which the second encountered section has a bore of at least 0.495 inch and exhibits a progressive bore in which at least two sub-sections of air path occur within the second encountered section, and in which a second encountered of the at least two sub-sections has a bore at least 0.007 inch larger than a first encountered of the at least two sub-sections of tubing, and in which the bore of the tubular main B-flat air path does not exceed 0.850 inch within the first 65% of the total primary B-flat air path length, and preferably does not exceed 0.790 inch within the first 65% of the total primary B-flat air path length,

and in which the progressive bore of tubing within the second encountered section is a bore progression selected from among a group consisting of progressively increasing cylindrical bores, a gradually expanding conical bore, and a combination of cylindrical and conical bores,

and in which the interface between the at least two sub-sections of differing bore within the second encountered section may be an interface selected from among a group consisting of a sudden stepped increase in cylindrical bore, a brief rapid conically expanding increase in bore, a gradual conically expanding increase in bore, and a combination of stepped cylindrical and conical expansions in bore.



12. A B-flat full double musical wind instrument according to claim 8, in which the bell throat diameter measured 10 inches from the exit end of the bell flare is between 1.2 inches and 2.5 inches in diameter.

13. The B-flat full double musical wind instrument according to claim 8, in which a first B-flat combination path length is approximately the summation of a tubular path length of a second of the at least three B-flat path associated tubular length extension detour air paths connected to a second encountered of the three remaining air valves in series within the tubular B-flat main air path and an air path length of the third internal air passage within the second encountered of the three remaining air valves, the first B-flat combination path length being approximately 5.946 percent of the total primary B-flat air path length,

and in which a second B-flat combination path length is approximately the summation of a tubular path length of a first of the at least three B-flat path associated tubular length extension detour air paths connected to a first encountered of the three remaining air valves in series with the tubular B-flat main air path and an air path length of the third internal air passage within the first encountered of the three remaining air valves, the second B-flat combination path length being approximately 5.946 percent of a second B-flat total path length, in which the second B-flat total path length is a summation of the total primary B-flat path length and the first B-flat combination path length,

and in which a third B-flat combination path length is approximately the summation of a tubular path length of a third of the at least three B-flat path associated tubular length extension detour air paths connected to a third encountered of the three remaining air valves in series with the tubular

B-flat main air path and an air path length of the third internal air passage within the third encountered of the three remaining air valves, the third B-flat combination path length being approximately 5.946 percent of a third B-flat total path length, in which the third B-flat total path length is a summation of the total primary B-flat path length and the second B-flat combination path length,

and in which a first F combination path length is approximately the summation of a tubular path length of a second of the at least three F path associated tubular length extension detour air paths connected to a second encountered of the three remaining air valves in series within the tubular F main air path and an air path length of the fourth internal air passage within the second encountered of the three remaining air valves, the first F combination path length being approximately 5.946 percent of the total primary F air path length,

and in which a second F combination path length is approximately the summation of a tubular path length of a first of the at least three F path associated tubular length extension detour air paths connected to a first encountered of the three remaining air valves in series with the tubular F main air path and an air path length of the fourth internal air passage within the first encountered of the three remaining air valves, the second F combination path length being approximately 5.946 percent of a second F total path length, in which the second F total path length is a summation of the total primary F path length and the first F combination path length,

and in which a third F combination path length is approximately the summation of a tubular path length of a third of the at least three F path associated tubular length extension detour air paths connected to a third

encountered of the three remaining air valves in series with the tubular F main air path and an air path length of the fourth internal air passage within the third encountered of the three remaining air valves, the third F combination path length being approximately 5.946 percent of a third F total path length, in which the third F total path length is a summation of the total primary F path length and the second F combination path length.

14. The B-flat full double musical wind instrument according to claim 8, in which the at least four air valves are selected from a group consisting of piston valves and rotary valves, in which the first encountered rotary valve is further selected from a group comprising conventional rotary valves, S.E. Shires rotary valves, O.E. Thayer rotary valves, R. Hagmann rotary valves, Greenhoe rotary valves, Willson Rotax rotary valves, C. Lindbergh rotary valves, or any rotary valve, and in which the remaining three rotary valves are further selected from a group comprising doubled conventional rotary valves, doubled S.E. Shires rotary valves, doubled O.E. Thayer rotary valves, doubled R. Hagmann rotary valves, doubled Greenhoe rotary valves, doubled Willson Rotax rotary valves, doubled C. Lindbergh rotary valves, or a doubled of any rotary valve.

15. A B-flat full double musical wind instrument according to claim 8 in which the first encountered valve has an internal rotor passage that slants diagonally from a lower rotor level to an upper rotor level.

16. A B-flat “compensating” musical wind instrument comprising,

an introductory tubular air path,

a primary tubular B-flat main air path,

an alternate tubular F main air path,

a B-flat/F path interconnect tube,

at least six length extension tubular detour air paths ,

at least four rotary air valves,

an exit tubular air path,

a tubular bell throat of progressively expanding bore, and

a tubular bell flare,

in which each of the valves has two operating positions including a disengaged first operating position and an engaged second operating position,

and in which a total primary B-flat air path comprises in series and in connected sequence, a space within a cupped mouthpiece and situated between an exit aperture formed within a performer's lip embouchure and an entrance to the introductory tubular air path, the introductory tubular air path, the primary tubular B-flat main air path, a first internal air passage within each of the at least four air valves, the first internal air passages within each of the at least four air valves being sequentially encountered in series with one another and contained in series within the primary tubular B-flat main air path, the exit tubular air path, the tubular bell throat, and the tubular bell flare, wherein the total primary B-flat air path is

approximately 108 inches in total path length, corresponding to the musical key of B-flat, when each of the at least four valves is in the disengaged first of the two valve operating positions,

and in which a total primary F air path comprises in series and in connected sequence, the space within the cupped mouthpiece and situated between the exit aperture formed within the performer's lip embouchure and the entrance to the introductory tubular air path, the introductory tubular air path, the primary tubular B-flat main air path, the first internal air passage within each of the at least four air valves and sequentially encountered in series with one another and contained in series within the primary tubular B-flat main air path, the B-flat/F path interconnect tube, the alternate tubular F main air path, a second internal air passage within each of the at least four air valves, the second internal air passages within each of the four air valves being sequentially encountered in series with one another and contained in series within the alternate tubular F main air path, the exit tubular air path, the tubular bell throat, and the tubular bell flare, wherein the total primary F air path is approximately 144 inches in total path length, corresponding to the musical key of F, when the fourth encountered of the at least four air valves is in the engaged second of the two valve operating positions, and when each of the first three encountered air valves of the at least four air valves are also in the disengaged first of the two valve operating positions,

and in which the primary tubular B-flat main air path is selected as a separate and distinct air path and the alternate tubular F path is bypassed when the fourth encountered valve is in the disengaged first of the two valve operating positions, and in which the primary tubular B-flat and the alternate tubular F main air path are both selected, becoming sequentially

shared air paths in series when the fourth encountered valve is in the engaged second of the two valve operating positions,

and in which the first internal air passages of the first three encountered of the at least four air valves are connected in series with one another and in series with the primary tubular B-flat main air path, a first entry port of each of the first three encountered of the at least four air valves sequentially receiving air from a segment of the primary tubular B-flat main air path and a first exit port of each of the first three encountered of the at least four air valves returning air to a continuation of the primary tubular B-flat main air path,

each of the first three encountered air valves of the at least four air valves containing at least four internal air passages and having an associated external valve actuator, and

the two valve operating positions of each of the first three encountered air valves of the at least four air valves selecting between immediate an continuation of an air flow in the primary tubular B-flat main air path and a diversion of the air flow into a specified valve associated one of the first three of the at least six tubular length extension detour air paths, in which the immediate continuation of the air flow in the primary tubular B-flat main air path is selected whenever the associated valve actuator of the specified valve selected from among the first three encountered air valves remains inactive causing a disengaged first of the two specified valve operating positions to be selected,

whereas the diversion of the air flow into the specified valve associated one of the first three of the at least six tubular length extension detour air paths is


selected whenever the associated valve actuator of the specified valve selected from among the first three encountered air valves is activated causing the engaged second of the two specified valve operating positions to be selected, the diversion of air flow received from the first entry port of the specified valve selected from among the first three encountered valves proceeding via diversion to a second exit port on the specified valve, the second exit port exiting to an entry end of a specified valve associated one of the first three of the at least six tubular length extension detour air paths external to the specified valve, and an exit end of the specified valve associated one of the first three of the at least six tubular length extension detour air paths being connected to a second entry port on the specified valve, causing the diverted air to return to the specified valve via the second entry port and an aligned third internal air passage selected from among the at least four internal air passages within the specified valve, the third internal air passage being further aligned with the first exit port of the specified valve, causing returned detoured air to exit the specified valve to a continuation of the primary tubular B-flat air path when the specified valve is in the engaged second of the two specified valve operating positions ,

and in which the second internal air passages of each of the first three encountered of the at least four air valves are connected in series with one another and in series with the alternate tubular F main air path, a third entry port of each of the first three encountered of the at least four air valves sequentially receiving air from a segment of the alternate tubular F main air path and a third exit port of each of the first three encountered of the at least four air valves returning air to a continuation of the alternate tubular F main air path whenever the fourth encountered air valve is in the engaged second of the two fourth encountered valve operating positions,

and the two valve operating positions of each of the first three encountered air valves of the at least four air valves alternatively selecting between immediate continuation of an air flow in the alternate tubular F main air path and diversion of the air flow into a specified valve associated one of the remaining three of the at least six tubular length extension detour air paths whenever the fourth encountered air valve is in the engaged second of the two fourth encountered valve operating positions, in which the immediate continuation of the air flow in the alternate tubular F main air path is selected whenever the associated valve actuator of the specified valve selected from among the first three encountered valves remains inactive causing a disengaged first of the two specified valve operating positions to be selected and whenever the fourth encountered valve is also in the engaged second of the two fourth encountered valve operating positions,

whereas the diversion of the air flow into the specified valve associated one of the remaining three of the at least six tubular length extension detour air paths is selected whenever the associated valve actuator of the specified valve selected from among the first three encountered valves is activated causing the engaged second of the two specified valve operating positions to be selected with the fourth encountered valve being in the engaged second of the two fourth encountered valve operating positions, the diversion of the air flow received from the third entry port of the specified valve selected from among the first three encountered valves proceeding via diversion to a fourth exit port on the specified valve, the fourth exit port exiting to an entry end of the specified valve associated one of the remaining three of the at least six tubular length extension detour air paths external to the specified valve, and an exit end of the specified valve associated one of the second three of the at least six tubular length extension detour air paths being connected to a fourth entry port on the specified valve, causing diverted air to return to the





specified valve via the fourth entry port and an aligned fourth internal air passage selected from among the at least four internal air passages within the specified valve, the fourth internal air passage being further aligned with the third exit port of the specified valve, causing the returned detoured air to exit the specified valve to a continuation of the alternate tubular F main air path when the specified valve is in the engaged second of the two specified valve operating conditions and the fourth encountered valve is also in the engaged second of the two fourth encountered valve operating positions,

and in which the internal air passages of the at least four valves exhibit bores of at least 0.490 inch, and in which bores of the first encountered approximately 65 percent of the total primary B-flat air path do not exceed 0.850 inch in diameter.

17. A B-flat full double wind instrument according to claim 8, in which the claim restrictions on bore and bell throat diameter are removed to create a double euphonium.

18. The musical wind instrument according to claim 6 with three air valves and three tubular length extension detour air paths, and in which air passages within the valves are at least 0.500 inch bore whereby the musical wind instrument having an overall physical length greater than 36 inches.